PATENT SPECIFICATION

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PROVISIONAL SPECIFICATION.

Improvements in and relating to the Separation of Dust and Fine Material from Powdered or Granular Material especially Coal.

I, ROLAND HERBERT ALLEN, of 19, Makepeace Avenue, Highgate, N. 6, in the County of London, a British Subject, do hereby declare the nature of this invention to be as follows:—

This invention has reference to improvements in and relating to the separation of dust and fine particles from a mixture of solid particles of different sizes. The object of the invention is to separate the mixture into its coarser and finer constituents, dividing it into two or more grades within desired limits of size.

This invention is particularly suitable for the removal of dust from coal prior to its treatment in a coal cleaning plant operating according to either a dry or wet process. It is also suitable for the separation of natural dust from coal in order to use the dust for powdered fuel firing. The use of the invention is not, however, restricted to these applications or to the treatment of coal.

Various methods have been adopted for the object of removing fine dust from coal. For example according to some processes the coal is allowed to pass over a series of inclined louvres through which air is blown, carrying the dust into a chamber in which it is precipitated or from which it is carried in a current of air for precipitation in another chamber. In this type of apparatus the time of contact of the air with the coarser pieces of coal is relatively short and the conditions are not favourable for the separation of fine material within the desired limits of size without including with it a considerable proportion of coarser particles, or alternatively of leaving an undesirably high proportion of fine material with the coarse fraction. In another process the coal is allowed to fall down a tube which is vertical or only slightly inclined from the vertical, against an upwardly flowing current of air. This provides a longer time contact but the accurate grading of the fine material is hindered by the downwardly falling coarse particles which tend to trap the fine particles which would otherwise be carried upwards by the air current. Moreover the height through which the coal is allowed to fall may cause breakage of the larger particles.

If a mixture of solid particles is allowed to slide down an inclined chute and to fall freely in air from the lower edge of the chute, the particles will describe a curved path, the shape of which will in general depend on the inclination of the chute and the velocity acquired by the particles in passing down it, and also by the resistance offered to the individual particles by the air through which they fall. The effect of this air resistance is to delay the fall of the fine particles to a greater extent than that of the coarser particles. Thus the dust will tend to be separated from the coarser particles. It is to be noted that this separation will be more pronounced than if the coal were allowed to fall vertically, for the curved path enables the dust to be separated more easily from the stream of coarser particles which tend to carry them downwards at a higher velocity than their natural rate of fall.

According to my invention this feature is utilised by introducing the coal or other material through an inclined chute into a duct having a curved lower side, the radius of curvature of the lower side increasing progressively from the point of junction with the chute to the bottom end of the duct. By suitably choosing the length and slope of the chute and the curvature of the duct it is theoretically possible to arrange it so that the coal particles passed over the curved lower side in close proximity thereto but without touching it. In practice, owing to the particles having different initial velocities, and owing to mutual interference and other causes, a proportion of the particles will slide down the curved surface, the friction of which will reduce their velocity. The pressure between the particles and the duct surface will, however, be reduced and will be less than in the case of a duct having an inclined flat lower side. The friction between the particles and the material of the duct is therefore reduced, resulting in a lessened tendency to breakage of the larger pieces. Furthermore the coal may be more easily thrown clear of the lower side without

undesirable shock than in the case of a flat lower side. For example suitable deflectors may be in the form of substantially flat plates arranged tangentially to the curved surface. These tangential plates may be arranged to throw the coal clear of the surface without however causing it to be thrown a considerable distance from the surface, to which it may return at a lower point without appreciable shock.

The separation of the dust and fine particles from the coarser particles is effected according to my invention by allowing the coal to fall down the duct in the manner above described, and at the same time causing a current of air or gas to pass upwardly through the duct in counter-current with the coal. As the coal is deflected away from the curved lower side the upwardly flowing gas is enabled to pass freely round the particles and to carry upwards the dust and fine particles which it is desired to remove. The object of the invention is furthered by introducing streams of gas under the deflectors into the duct. These gas streams passing through the falling streams of coal cause the dust and fine particles to be carried to the upper side of the stream where they are met by the upwardly flowing gas current and carried upwards. Owing to the features above mentioned the larger particles are not thrown right across the gas stream and therefore do not seriously hinder the upward flow of the fine particles. Furthermore there results a desirable reduction in the resistance to flow of the gas as compared for example with that which obtains in apparatus embodying substantially vertical ducts.

In order to separate the fine particles from the coarse it is necessary to employ considerably higher gas velocities than would be required for carrying the fine particles only up a vertical duct. As a result a considerable proportion of particles of intermediate size tend to be held in suspension or carried upwards. To some extent these intermediate sizes are carried downwards and through the coarse material discharge port by the larger pieces which collide with them. Their separation from the dust is facilitated by gradually reducing the gas velocity as it travels upwards, thus allowing the coarser suspended particles to fall out of the gas stream on to the downwardly flowing coal. The reduction in gas velocity is effected by increasing the cross section of the duct and the increase of cross section of the upper portions must allow for the increase in the gas quantity due to the gas admitted behind the various deflectors. The increase of cross section may be effected by increasing the dimensions of the duct in either or both directions, but it is desirable that the upper side of the duct shall be curved in a similar manner to the lower side, although not necessarily parallel to it. The curved path of the upwardly flowing gas is of assistance in the separation of the coarser suspended particles from the gas stream for the smallest particles will have the highest velocity and will therefore be subjected to the greatest centrifugal force. They will therefore tend to segregate near the upper side of the duct and the coarser particles will tend to take up an intermediate position. Moreover the separation of the coarser from the finer suspended particles is accelerated by the deflection of the gas stream into a more nearly horizontal direction near the top of the separating duct. The separation of the coarser particles which it is desired to exclude from the dust may be furthered by passing the gas stream through an inclined classifying duct forming a continuation of the separating duct above the coal inlet chute. The material of intermediate size which falls out of the gas stream in the classifying section may be allowed to return down the tube to the separating section or may be removed from the classifier through a suitable port. Gas may be admitted through the discharge chute and port in order to prevent the escape of any fine material.

The gas with the suspended particles is delivered through suitable ducting from a point above the coal inlet, or from the upper end of the classifier when provided, into a settling chamber, separating unit, or filter of known type for the deposition of the dust and fines. If the apparatus is operating on closed circuit the gas is then returned to the separating tube, entering by a port at its lower end and by the supplementary inlets behind the deflectors. Alternatively if the system is working on open or partially open circuit the exhaust from the settling chamber may be discharged into the atmosphere or into a boiler furnace or chimney as desired. The gas is preferably circulated by a centrifugal fan which is preferably arranged on the exhaust side of the settling chamber. It is important that the volume of gas flowing should be correctly regulated and it is therefore preferably passed through a suitable meter for measuring the rate of flow. A separate meter may advantageously be used for measuring the air or gas supplied through the supplementary inlets.

It is desirable that the coal should be supplied to the apparatus at a uniform

rate and a mechanical feeding device such as a rotary valve may be used for this purpose. This device may advantageously be used as an air seal. Similarly a mechanical air sealing device may be employed for removing the de-dusted material from the bottom of the separating duct. This is especially desirable when the gas is circulated in closed circuit.

In a preferred form of the invention the separating duct is formed of sheet steel with two flat and two curved sides. The lower side is composed of a series of substantially flat plates whose lower edges overlap the adjacent plates and conform to a regular curve (when viewed in elevation) whose radius progressively increase from the top of the duct to the bottom. The upper end of the duct may be approximately tangential to the lower side of the coal inlet chute which is attached thereto, and which may be inclined at an angle of about 45° to the horizon. The lower end of the curved side of duct may be substantially vertical. The upper side of the duct is also curved in conformity with the lower side, but the distance between the upper and lower sides progressively increases from bottom to top as already described. The flat sides may be parallel or they may be farther apart at the top than at the lower end, in which case riffles may be attached to their inner sides at intervals to throw off particles of coal sliding down them. The separating duct is terminated by a port for removal of the de-dusted material which may be removed through a mechanically operated air-sealing discharge valve. The mechanism may consist of a rubber and canvas belt carrying transverse flights and whose upper surface moves at such a speed and inclination that the relative velocity between the falling coal and the belt is small thus minimising the risk of breakage of the coal. The air or gas is admitted at a point above the coal discharge port through a duct attached to the separating duct so that the gas is directed upwardly as it enters the separating duct. Curved plates may be fitted in the inlet branch to facilitate this. Preferably the inlet is on the same side of the duct as the coal inlet and in this case the side of the duct immediately above the connection of the gas inlet may be given a slight curvature towards the opposite side in order to throw the de-dusted material away from the gas inlet duct and towards the discharge port.

A sheet steel chamber is arranged behind the lower side of the separating duct and the sides of this chamber may conveniently be formed by an extension of the flat sides of the duct. This chamber communicates with the gas duct delivering the gas to the bottom of the separator and an adjustable damper may be disposed in the communicating duct in order to control the volume of gas delivered to the chamber. Gas passes from this chamber through openings behind the deflector plates and into the main separating duct. The deflecting plates may be provided on their under sides with curved guides to facilitate the entry of the gas without undue frictional loss. The inlets so formed may be equipped with adjustable damper plates so as to permit control of the gas volume passing behind each plate. The lower edges of the deflector plates may be beaded or rounded to facilitate the junction of the supplementary gas streams with the main gas stream passing up the separator. The gas chamber may be extended, in order to deliver gas under a deflector attached to the lower side of the coal inlet chute, so that gas may be admitted with the coal flowing down the chute. All or any of the deflectors may be adjustably mounted so that the best arrangement of each one may be found by experiment to suit the material being treated.

A tubular classifier, preferably of rectangular cross section, may be provided if desired, forming an inclined continuation of the ducting above the coal inlet chute. The inclination of the classifier may conveniently be in the opposite direction to that of the separator but this is not essential. The classifier may be fitted internally with one or more adjustable plates approximately parallel to the gas stream and to the inclined sides of the classifier, in order to facilitate separation of the coarser particles from the dust without requiring excessive length of the classifier. A port may be provided on the lower side of the classifier for removal of the medium fine material deposited in this section. This material may be discharged through an air sealing valve into a hopper as a separate product or it may be returned to the separating portion of the ducting for re-treatment. The outlet chute may be connected to the main gas supply duct by means of a suitable pipe in order to supply a current of gas for removal of any fine dust from the medium fine material. The gas and suspended dust are conducted from the top of the classifier, or from the separating ducting a short distance above the coal inlet when no classifier is provided, through suitable piping to the dust separating unit. The cleaned gas from the cyclone or separator is then conducted to the inlet of a centrifugal fan whence it is delivered

through suitable ducting to the inlet at the lower end of the separating duct. If desired, however a portion or the whole of the gas may be delivered from the fan to atmosphere or to some other plant or apparatus. This has the advantage of reducing the pressure in the system so that any leakage which may occur, for example at the coal inlet and outlet ports, will be inwards, and there will be no risk of dust emission into the atmosphere. In some cases it may be possible by this means to dispense with air-sealing valves at these points. When the coal being treated contains more than two or three percent of free moisture it is very desirable that a portion or the whole of the gas should be discharged from the system otherwise it quickly becomes saturated and it is not possible to remove all the dust from the coal. In the case of moist coal it is very advantageous to introduce heated air or gas through the supplementary inlets in order to dry the coal and allow the gas to remove dust which would otherwise adhere to the larger particles. In this case it is essential that gas should be discharged continuously from the apparatus.

An adjustable damper is provided on either the inlet or discharge side of the fan in order to control the rate of air flow in accordance with the indication of the meter already referred to. This control may be effected automatically if desired. Supplementary gas currents may be delivered into the classifier, when provided, in order to alter the relative velocities of the gas in the classifier and separating portions.

All the walls and external joints of the apparatus must of course be gas tight. Rubber linings may be provided for the deflecting plates and the coal inlet and outlet ducts if desired, in order to reduce risk of breakage of the larger pieces of coal. The deflectors may be made slightly convex upwards when viewed endways in order to prevent the larger pieces of material, which will travel faster, from concentrating towards the centre of the duct. Alternatively the lower edges of the deflectors may be slightly curved, making the centre portions lower than the sides, in order to produce the same effect. Riffles may be provided on the lower side of the duct in order to impart a spinning movement to the larger particles, thus causing them to present all their surfaces to the upwardly flowing air and assist in removing adhering dust.

The larger sizes of coal, for example above ½ inch mesh, may generally be effectively de-dusted by passing them over vibrating screens, so that the small material together with nearly all of the dust passes through the mesh. This undersize material may then be treated in the apparatus described. It is advantageous to enclose the vibrating screen in a dust tight casing and to draw through the casing, preferably downwardly through the mesh, a current of air or gas. This gas may then be delivered into the dust separating unit. The screen casing can be included in a closed circuit by delivering to it air or gas from the fan and making a return connection between the upper portion of the de-dusting apparatus and the cyclone or other dust precipitating device; a damper will be required in one or both of these gas pipes. It is generally more satisfactory not to include the screen in a closed circuit but to draw cold air through the casing into the de-dusting unit, and to discharge air from the latter —after cleaning—to atmosphere in order to compensate for the air thus drawn in.

Dated the 11th day of January, 1933.

R. H. ALLEN.

COMPLETE SPECIFICATION.

Improvements in and relating to the Separation of Dust and Fine Material from Powdered or Granular Material especially Coal.

I, ROLAND HERBERT ALLEN, of 19, Makepeace Avenue, Highgate, N. 6, in the County of London, a British Subject, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The invention relates to the separation of dust and fine particles from a mixture of solid particles of different sizes, and provides improved means for separating the mixture into its coarser and finer constituents and dividing it into two or more grades within desired limits of size.

The invention is particularly suitable for the removal of dust from coal prior to its treatment in a coal cleaning plant operat-

ing on either the dry or the wet process. It is also suitable for the separation of natural dust from coal where the dust obtained is to be used for pulverised fuel firing. The invention is not, however, restricted to these applications or even to the treatment of coal.

Various methods have previously been adopted with the object of removing fine dust from coal. For example according to some processes the coal is allowed to pass over a series of gently inclined louvres through which air is blown, carrying the dust into a chamber in which it is precipitated or from which it is carried in a current of air for precipitation in another chamber. In this type of apparatus the time of contact of the air with the coarser pieces of coal is relatively short and the conditions are not favourable for the separation of fine material within the desired limits of size without including with it a considerable proportion of coarser particles, or alternatively of leaving an undesirably high proportion of fine material with the coarse fraction. In another process the coal is allowed to fall down a tube which is vertical or only slightly inclined from the vertical, against an upwardly flowing current of air. This provides a longer time contact of air with coal due to the free path but the accurate grading of the fine material is hindered by the downwardly falling coarse particles; these tend to trap fine particles which would otherwise be carried upwards by the air current. Moreover the height through which the coal is allowed to fall is apt to cause breakage of the larger particles.

The present invention is directed to an improvement in the type of apparatus for removing dust and/or fine material from granular or lump material which comprises an elongated sloping separating chamber adapted for the passage of the material down its lower side, means for feeding the material to be treated to the upper end of the sloping lower side and discharge means for dust-laden air or gas at the top end of the chamber and for the de-dusted material at the bottom end thereof, and which is arranged so that air or other gas is adapted to enter the chamber through apertures in the lower side and to pass through the stream of material. The invention consists in forming the lower side of the chamber so that its slope gradually increases from the top downwards. In other words the lower side is curved with its convex side uppermost. Due to the elongated shape of the chamber the air or gas passes along the stream of material in counter-current and in close contact with it. This provides for a prolonged contact of air and coal, assuming the apparatus is used for cleaning coal.

The variation in slope of the lower side causes a gradual reduction of the vertical component of gas velocity towards the top end which will allow over size particles of dust to fall out of the stream and rejoin the downwardly flowing coarse material. The flow of gas in the separating chamber may be supplemented by gas introduced at the bottom, preferably through the falling material, and both streams of gas are advantageously provided with independent means of regulation.

If a mixture of solid particles is allowed to slide down an inclined chute and to fall freely in air from the lower edge of the chute, the particles will describe a curved path, the shape of which will in general depend on the inclination of the chute and the velocity acquired by the particles in passing down it, and also by the resistance offered to the individual particles by the air through which they fall. The effect of this air resistance is to delay the fall of the fine particles to a greater extent than that of the coarser particles. Thus the dust will tend to be separated from the coarser particles. It is to be noted that this separation will be more pronounced than if the coal were allowed to fall vertically, for the curved path enables the dust to be separated more easily from the stream of coarser particles which tend to carry it downwards at a higher velocity than the natural rate of fall.

This phenomenon is turned to account by a further feature of the invention by making the feeding means for the coal or other material in the form of an inclined chute and so forming the curved lower side of the separating chamber that its radius of curvature increases progressively from the point of junction with the chute to the bottom end of the chamber. The feed chute will of course form a tangent to the curved lower side where it meets the latter. By suitably choosing the length and slope of the chute and the curvature of the lower side of the separating chamber it is theoretically possible to arrange it so that the coal particles pass over the curved lower side in close proximity thereto but without touching it. In practice, owing to the particles having different initial velocities, and owing to mutual interference and other causes, a proportion of the particles will slide down the curved surface, the friction of which will reduce their velocity. The pressure between the particles and the curved surface will, however, be

reduced to a minimum and will be less than in the case of a separating chamber having an inclined flat lower side. The friction between the particles and the material of the lower side is therefore reduced, resulting in a lessened tendency to breakage of the larger pieces. Furthermore the coal may be more easily thrown clear of the lower side without undesirable shock than in the case of a flat lower side. By way of example, suitable deflectors may be in the form of substantially flat plates arranged tangentially to the curved surface. These tangential plates may be arranged to throw the coal clear of the surface without however causing it to be thrown a considerable distance from the surface, to which it may return at a lower point without appreciable shock.

The accompanying drawings show an embodiment of the invention and therein

Figure 1 is a diagrammatic sectional elevation of a coal de-duster,

Figure 2 is a similar view on a smaller scale showing also the associated apparatus, and

Figure 3 is a detail.

Referring to the drawings, a separating chamber 1 has a sloping lower side built up of separate plates 2 adjustably fixed to the sides of the chamber and arranged to have their main surfaces more or less following a curve. Gaps are left between the plates for the passage of air and the passages are suitably directed by the addition of blocks 3, 4, as shown, to the plates 2. The plates may be of sheet steel extending right across the width of the chamber and the blocks are conveniently of wood.

The coal to be treated is contained in a hopper 5 from which it is fed by a rotary valve 6, constituting an air lock, on to a chute 7. The dust-laden air is discharged at the upper end by the flue 8 and the coal is discharged at the lower end 9. The plates 2 are set on a curve so that the slope of the lower side of the chamber gradually increases from the upper end downwards. At the same time the distance of the upper side 41 of the chamber from the plates 2 constituting its lower side progressively increases from the lower end to the upper. The effect of this construction is that in spite of the additional air joining the stream from successive apertures between the plates 2 the vertical component of air velocity in the upwardly flowing stream gradually decreases from the lower end to the upper end.

The air is supplied by a fan 10 through a duct 11 to the underside of the plates 2. A damper 12 serves to regulate the total quantity of air supplied to the gaps between the plates and a further damper 13 regulates its distribution as between the lower and upper parts of the de-dusting surface.

A branch duct 14 with regulating damper 15 conducts a portion of the air from the fan to the coal outlet 9 to supplement the air entering the chamber from between the plates 2 and the whole of this air passes in counter-current to the falling coal. A baffle 16 assists in making the air flow smooth and a wire mesh 17 prevents any stray pieces of coal from falling into the duct 14. If any particles of coarser dust should pass through the mesh 17 they are caught in the coal trap 18. Deflectors 19 serve to guide the falling coal and prevent breakage as it collects at the final outlet 20. The latter is suitably trapped to prevent loss of air.

The chamber 1 is provided with an access door 21 for cleaning and adjustment and a window 22 permits observation during operation.

It will be seen that both streams of air cooperate in the removal of dust and on account of the curvature of the surface constituted by the series of plates 2 the coal behaves almost as if it were falling freely. The air has access to all sides of the pieces and effectively removes the dust which is carried to the upper side of the chamber 1 to be discharged at 8 by the upward current of air.

Owing to the features above mentioned the larger particles are not thrown right across the air stream and therefore do not seriously hinder the upward flow of the fine particles. Furthermore there results a desirable reduction in the resistance to flow of the air as compared for example with that which obtains in apparatus employing a substantially vertical separating duct.

In order to separate the fine particles from the coarse, it is necessary to employ considerably higher air velocities than would be required for carrying the fine particles only up a vertical duct. As a result a considerable proportion of particles of intermediate size tend to be held in suspension or carried upwards. To some extent these intermediate sizes are carried downwards and through the coarse material discharge port by the larger pieces which collide with them. Their separation from the dust is facilitated by the gradual reduction of the air velocity already mentioned as it travels upwards, thus allowing the coarser suspended particles to fall out of the air stream on to the downwardly flowing coal. The increase of cross section may be effected by increasing the dimensions of the chamber in

either or both directions, but it is desirable that the upper side of the chamber shall be curved in a similar manner to the lower side, although not necessarily parallel to it. This can be clearly seen in figure 1. The curved path of the upwardly flowing air is of assistaice in the separation of the coarser suspended particles from the gas stream, for the smallest particles will have the highest velocity and will therefore be subjected to the greatest centrifugal force. They will therefore tend to segregate near the upper side of the chamber and the coarser particles will tend to take up an intermediate position. Moreover the separation of the coarser from the finer suspended particles is accelerated by the deflection of the air stream into a more nearly horizontal direction towards the top of the chamber, so that the vertical component of velocity is decreased in this way also.

The separation of the coarser particles which it is desired to exclude from the dust is furthered in the embodiment shown by passing the air stream from the outlet 8 through a curved classifying duct 23 forming a continuation of the outlet 8 of the separating chamber 1. The outer side of this duct is formed of two interleaved flaps 24, 25, hinged at 26 and 27 respectively. A screwed rod 28 attached to the flap 24 passes through the outer side of the duct 23 and is provided with an adjusting nut 29 and spring 30 to allow of a variation of cross-section. If the cross-section is increased more of the coarse particles will fail to be carried by the air current and will fall on the inner side of the duct, to slide down and rejoin the coal being discharged at 9.

The duct could also be made straight and of suitable slope or even horizontal and with a straight or curved duct an arrangement may be fitted to extract the coarse dust collected instead of allowing it to pass out with the de-dusted coal. Air may be admitted at this separate outlet to prevent the escape of fine dust. The use of such an arrangement will depend on the final product required.

In the arrangement of plant illustrated it is desirable to conduct the coarser dust deposited to a part of the air stream moving at a lower velocity. This is effected by fitting on the inner side of the bend shallow deflectors 31 as shown in figure 3. These direct the dust to the corners of the duct where the air velocity is less than at the centre.

The air with the suspended particles is delivered in the example shown from the upper end of the classifier 23 into a settling chamber 32, which could be replaced if required by a separating unit or a filter of known type, for the deposition of the dust and fines. The settling chamber 32 comprises a downwardly directed bend with outlet 33 for the medium dust. The cross-section of the chamber can be varied by moving the flap 34 up or down by means of a screwed rod 35 and nut 36.

While the discharged air can be used if found suitable for a boiler or other furnace, it will be necessary in a closed system, such as is shown, to remove the fine dust This is accomplished by a cyclone separator 37 which is advantageously of the type described in patent specifications Nos. 411,121, 411,122 and 411,123.

The discharged air from the cyclone separator is passed through a Venturi tube 38 by means of which an indication of the rate of flow can be obtained, and is returned to the inlet of the fan 10. Any adjustment of the flow can be accomplished by varying the fan speed or by means of the damper 39. Similar arrangements for indicating the air flow may be used at other parts of the air circuit, e.g. in the branches 11 and 14. Moreover the dampers may if desired be automatically controlled.

If desired a portion or the whole of the air may be delivered from the fan to atmosphere by the alternative discharge 40 shown dotted or to some other plant or apparatus. This has the advantage of reducing the pressure in the system so that any leakage which may occur, for example at the coal inlet and outlet ports, will be inwards, and there will be no risk of dust escaping into the atmosphere. In some cases it may be possible by this means to dispense with air-sealing valves at these points. When the coal being treated contains more than two or three per cent. of free moisture it is very desirable that a portion or the whole of the air or other gas should be discharged from the system, otherwise it quickly becomes saturated and it is not possible to remove all the dust from the coal. In the case of moist coal it is very advantageous to introduce heated air or gas through the inlets between the plates 2 in order to dry the coal and allow this air or gas to remove dust which would otherwise adhere to the larger particles. In this case it is essential that gas should be discharged continuously from the apparatus. Advantageously cold air enters at 9 which will cool the de-dusted coal before it is discharged.

All the walls and external joints of the apparatus must of course be air tight. Rubber linings may be provided for the deflecting plates 2 and the coal inlet and outlet ducts if desired, in order to reduce

risk of breakage of the larger pieces of coal. The deflectors may be made slightly convex upwards when viewed endways in order to prevent the larger pieces of material, which will travel faster, from concentrating towards the centre of the duct. Alternatively the lower edges of the deflectors may be slightly curved, making the centre portions lower than the sides, in order to produce the same effect. Riffles may be provided on the plates 2 in order to impart a spinning movement to the larger particles, thus causing them to present all their surfaces to the upwardly flowing air and assist in removing adhereing dust.

The larger sizes of coal, for example above ½ inch mesh, may generally be effectively de-dusted by passing them over vibrating screens, so that the small material together with nearly all of the dust passes through the mesh. This undersize material may then be treated in the apparatus described above. It is advantageous to enclose the vibrating screen in a dust tight casing and to draw through the casing, preferably downwardly through the mesh, a current of air or gas. This gas may then be delivered into the dust separating unit. The screen casing can be included in a closed circuit by delivering to it air or gas from the fan 10 and making a return connection to a point between the duct 23 and the settling chamber 32; a damper will be required in one or both of the circuits. The coal passing through the screen and containing a considerable quantity of dust is then fed to the hopper 5. It is generally more satisfactory, however, not to include the screen in a closed circuit but to draw cold air through the screen casing into the de-dusting unit, and to discharge air from the latter—after cleaning—to atmosphere in order to compensate for the air thus drawn in.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. Apparatus of the kind referred to for removing dust and/or fine material from granular or lump material comprising an elongated separating chamber with a lower side set at a slope gradually increasing from the top downwards.

2. Apparatus as claimed in claim 1 comprising a supplementary air or gas inlet at the lower end of the separating chamber.

3. Apparatus as claimed in claim 2 having means for regulating the relative flow of air or gas through the apertures in the side of the chamber and into the bottom inlet.

4. Apparatus as claimed in any of claims 1 to 3, having means for regulating the relative flow of air or gas as between the upper and lower apertures in the side of the chamber.

5. Apparatus as claimed in any of claims 1 to 4 in which the lower side of the separating chamber is curved with a gradually increasing radius of curvature from top to bottom.

6. Apparatus as claimed in any of claims 1 to 5 in which the lower side of the separating chamber is constituted of a plurality of plates with intervening gaps for the passage of the air or gas through the stream of material.

7. Apparatus as claimed in claim 6 in which the plates are separately adjustable in slope.

8. Apparatus as claimed in any of the preceding claims comprising also a classifying duct attached to the gas outlet of the chamber.

9. Apparatus as claimed in claim 8 in which the cross-section of the classifying duct is adjustable.

10. Apparatus as claimed in claim 8 in which the inner side of the classifying duct is provided with deflectors to pass the deposited dust to the corners.

11. Apparatus as claimed in any of the preceding claims in which the separating chamber is provided with windows for observation during operation.

12. Apparatus as claimed in any of the preceding claims comprising also a fan and a cyclone or other dust extractor, the whole working on a closed system of air circulation.

13. Apparatus for removing dust and/or fine material from granular or lump material substantially as shown in the accompanying drawings and as described with reference thereto.

Dated the 10th day of January, 1934.
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Redhill: Printed for His Majesty's Stationery Office, by Love & Malcomson, Ltd.—1934

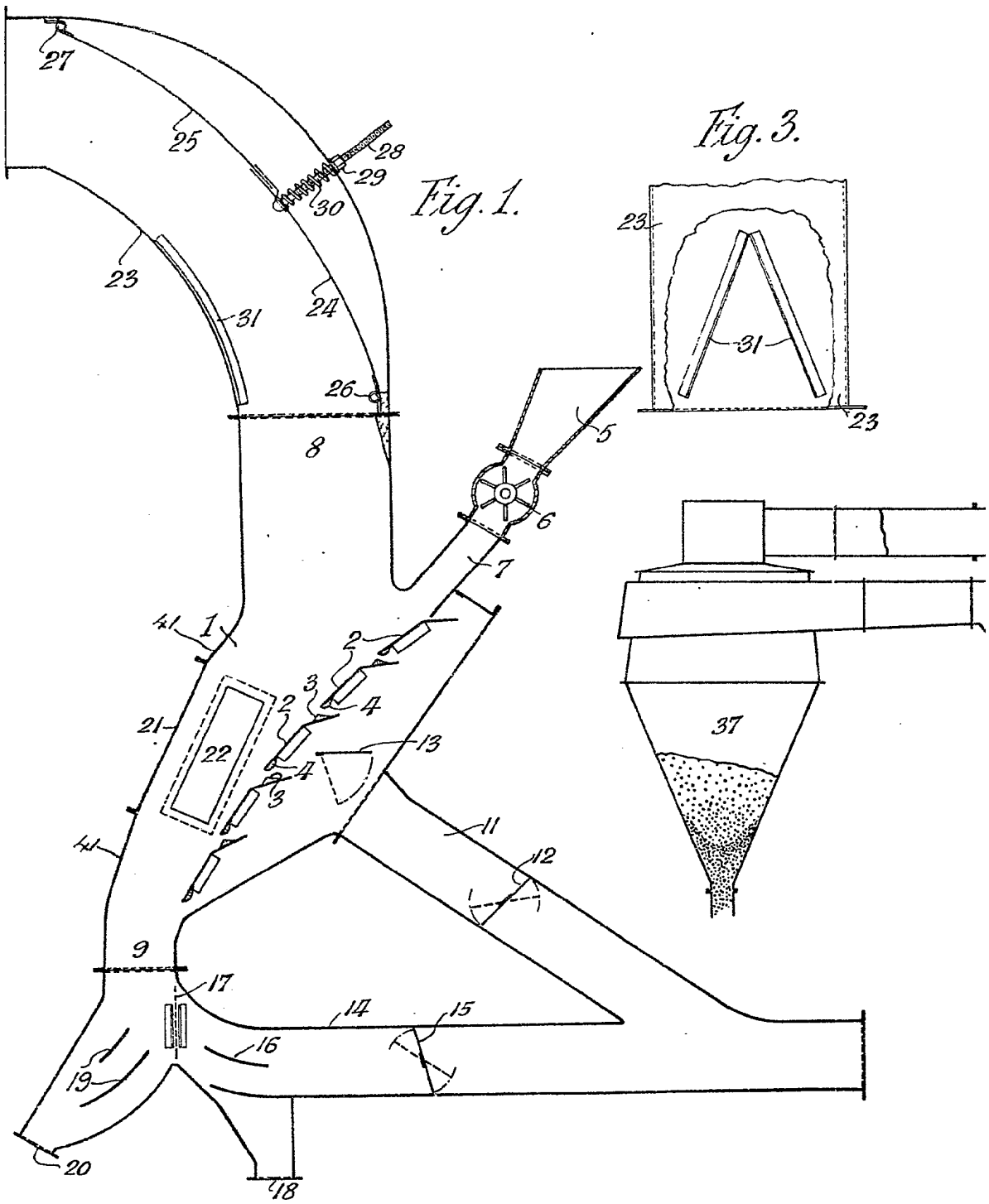
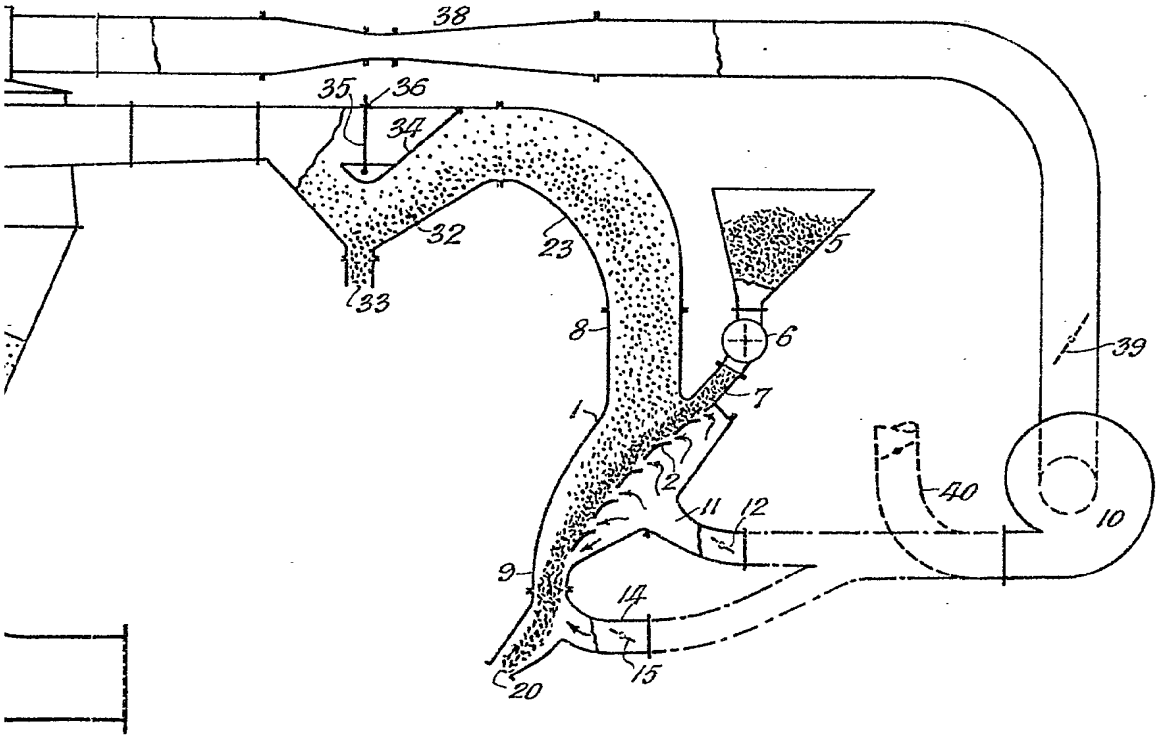


Fig. 1.

Fig. 3.

: 3.

Fig. 2.



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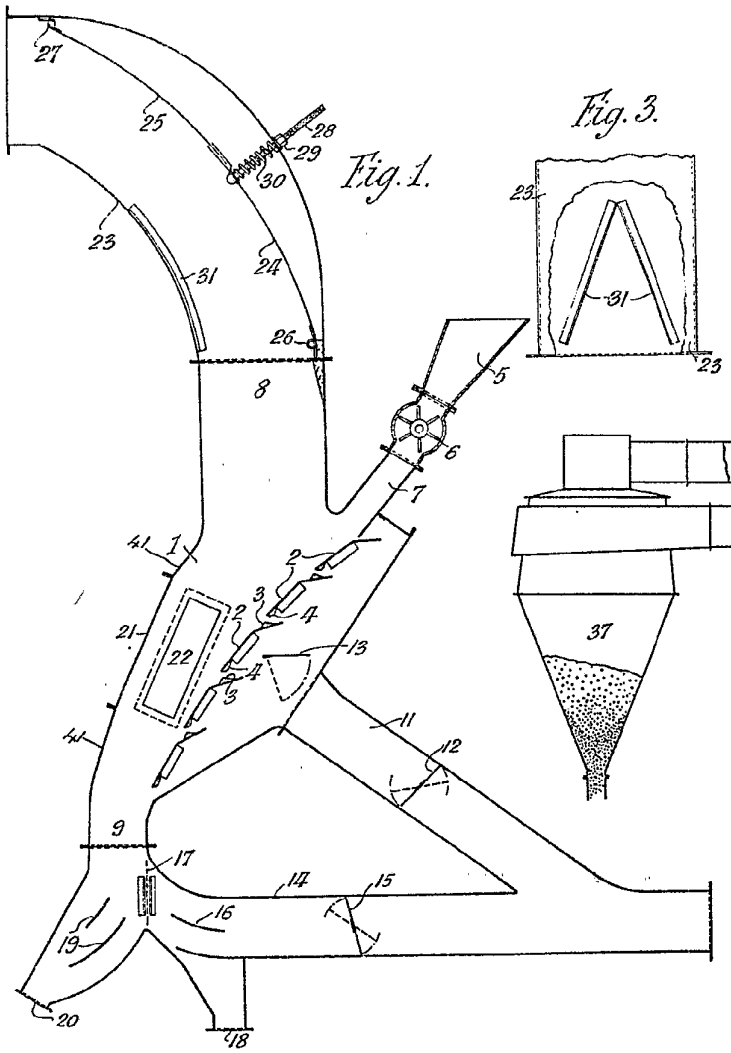

Fig. 1.

Fig. 3.

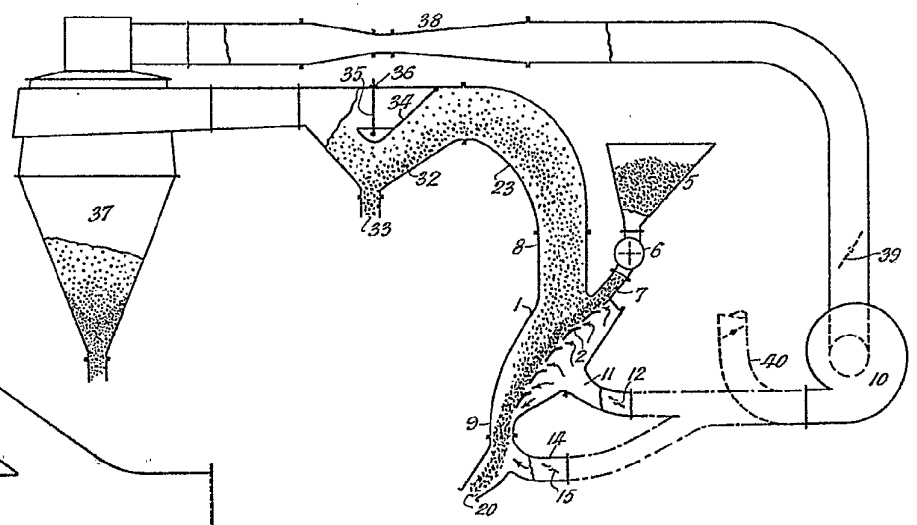

Fig. 2.

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